US009450985B2

(12) **United States Patent**
Chieu et al.

(10) **Patent No.: US 9,450,985 B2**
(45) **Date of Patent: Sep. 20, 2016**

(54) **SERVER VALIDATION WITH DYNAMIC ASSEMBLY OF SCRIPTS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/450,422**

(22) Filed: **Aug. 4, 2014**

(65) **Prior Publication Data**

US 2016/0036858 A1 Feb. 4, 2016

(51) **Int. Cl.**

G06F 9/445 (2006.01)
H04L 29/06 (2006.01)
H04L 29/08 (2006.01)

(52) **U.S. Cl.**

CPC ***H04L 63/20*** (2013.01); ***H04L 67/10*** (2013.01); *G06F 8/60* (2013.01)

(58) **Field of Classification Search**

CPC G06F 8/60; G06F 8/63; G06F 8/70; G06F 8/73; H04L 63/20
USPC 717/168–178
See application file for complete search history.

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(57) **ABSTRACT**

Systems and methods for computer automated validation of server configurations are provided. A method for validation of a target environment, comprises assembling a validation script from a plurality of script fragments, inserting the assembled validation script into the target environment, executing the validation script in the target environment, gathering results of the executing, and reporting the results to at least one user.

16 Claims, 9 Drawing Sheets

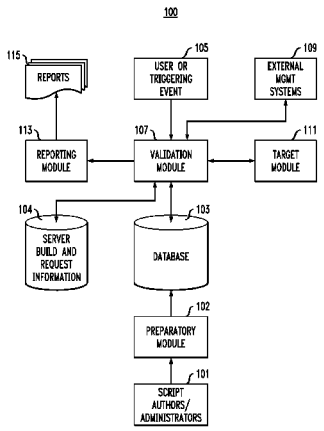


FIG. 1

100

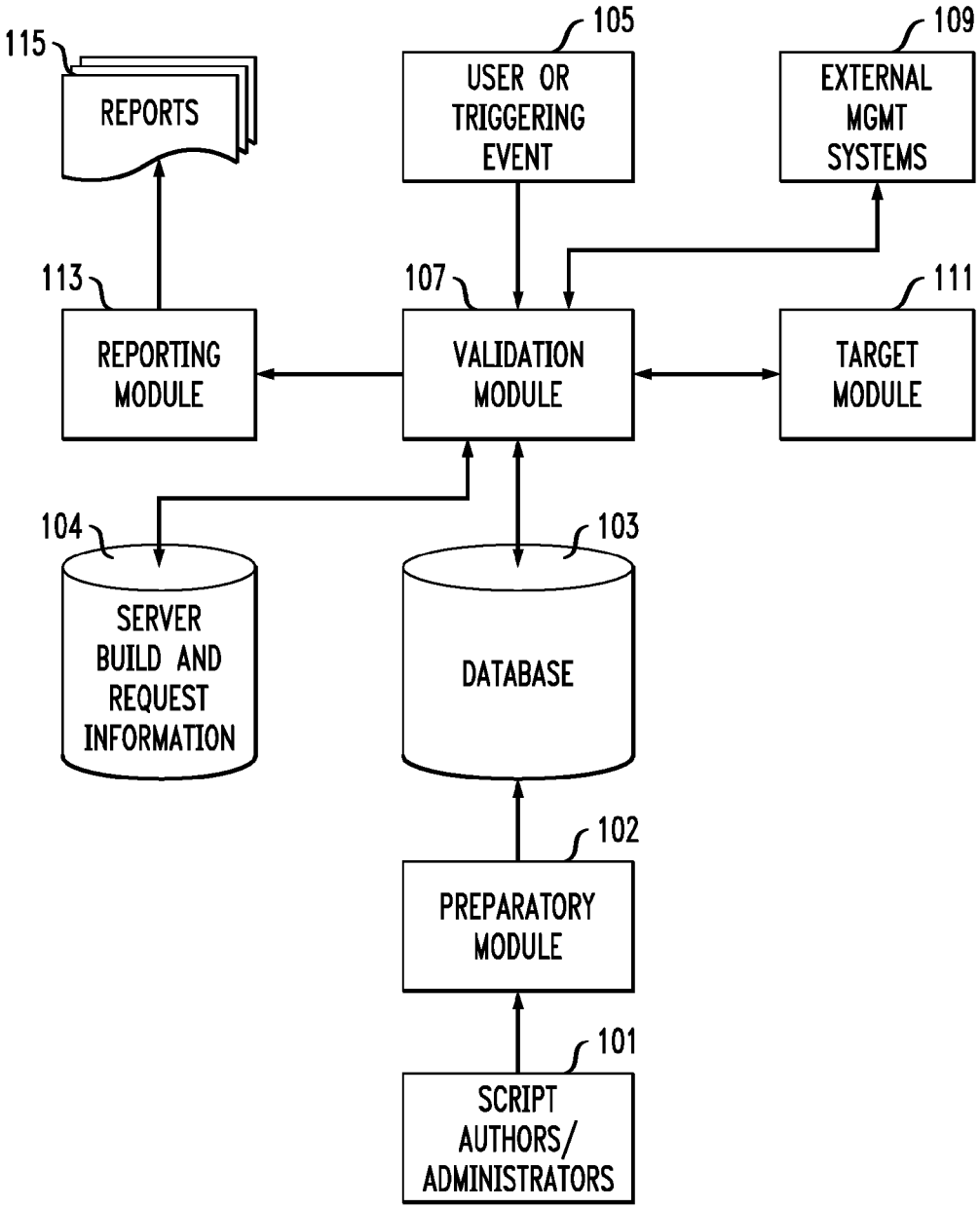
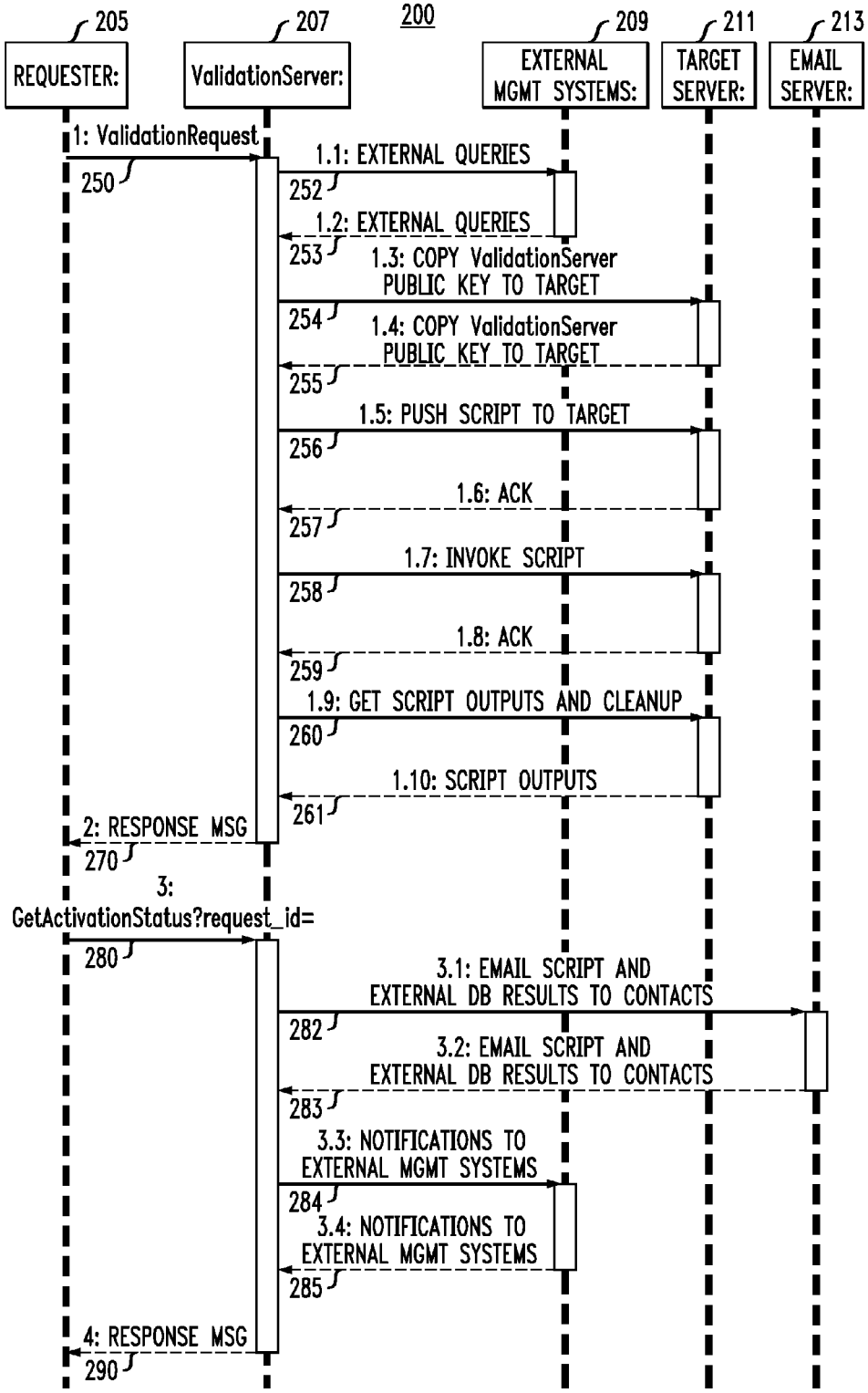

115
REPORTS
105
USER OR TRIGGERING EVENT
109
EXTERNAL MGMT SYSTEMS
113
REPORTING MODULE
107
VALIDATION MODULE
111
TARGET MODULE
104
SERVER BUILD AND REQUEST INFORMATION
103
DATABASE
102
PREPARATORY MODULE
101
SCRIPT AUTHORS/ ADMINISTRATORS

FIG. 2


200
205
REQUESTER:
207
ValidationServer:
209
EXTERNAL MGMT SYSTEMS:
211
TARGET SERVER:
213
EMAIL SERVER:
1: ValidationRequest
250
1.1: EXTERNAL QUERIES
252
1.2: EXTERNAL QUERIES
253
1.3: COPY ValidationServer PUBLIC KEY TO TARGET
254
1.4: COPY ValidationServer PUBLIC KEY TO TARGET
255
1.5: PUSH SCRIPT TO TARGET
256
1.6: ACK
257
1.7: INVOKE SCRIPT
258
1.8: ACK
259
1.9: GET SCRIPT OUTPUTS AND CLEANUP
260
1.10: SCRIPT OUTPUTS
261
2: RESPONSE MSG
270
3: GetActivationStatus?request_id=
280
3.1: EMAIL SCRIPT AND EXTERNAL DB RESULTS TO CONTACTS
282
3.2: EMAIL SCRIPT AND EXTERNAL DB RESULTS TO CONTACTS
283
3.3: NOTIFICATIONS TO EXTERNAL MGMT SYSTEMS
284
3.4: NOTIFICATIONS TO EXTERNAL MGMT SYSTEMS
285
4: RESPONSE MSG
290

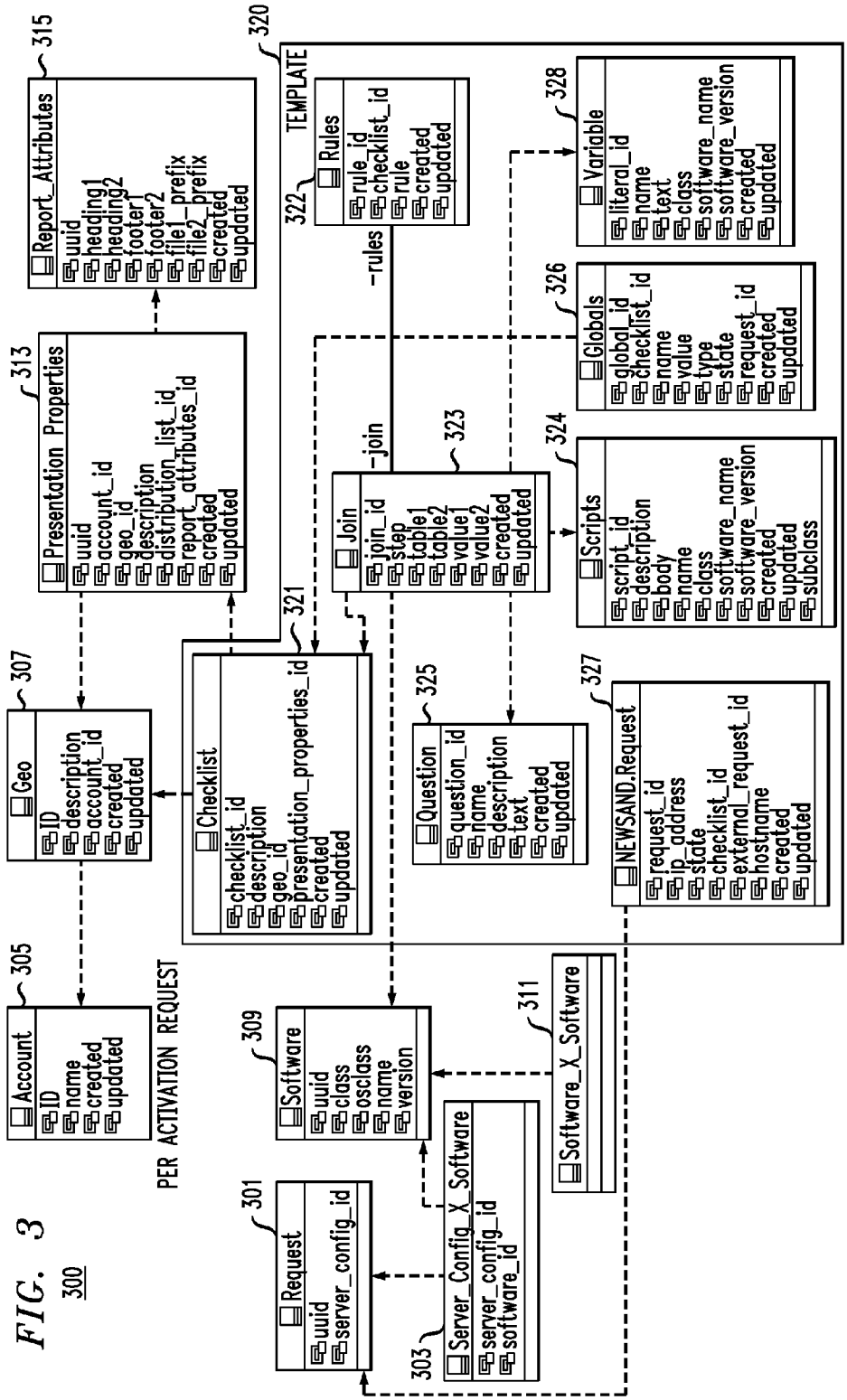

300
Report_Attributes
uuid
heading1
heading2
footer1
footer2
file1_prefix
file2_prefix
created
updated
315
320
TEMPLATE
Rules
rule_id
checklist_id
rule
created
updated
322
328
Variable
literal_id
name
text
class
software_name
software_version
created
updated
-rules
Presentation_Properties
uuid
account_id
geo_id
description
distribution_list_id
report_attributes_id
created
updated
313
326
Globals
global_id
checklist_id
name
value
type
state
request_id
created
updated
-join
323
324
Join
join_id
step
table1
table2
value1
value2
created
updated
Scripts
script_id
description
body
name
class
software_name
software_version
created
updated
subclass
307
321
Geo
ID
description
account_id
created
updated
Checklist
checklist_id
description
geo_id
presentation_properties_id
created
updated
325
Question
question_id
name
description
text
created
updated
327
NEWSAND.Request
request_id
ip_address
state
checklist_id
external_request_id
hostname
created
updated
305
Account
ID
name
created
updated
PER ACTIVATION REQUEST
309
Software
uuid
class
osclass
name
version
311
Software_X_Software
301
Request
uuid
server_config_id
303
Server_Config_X_Software
server_config_id
software_id

FIG. 3

FIG. 4

400

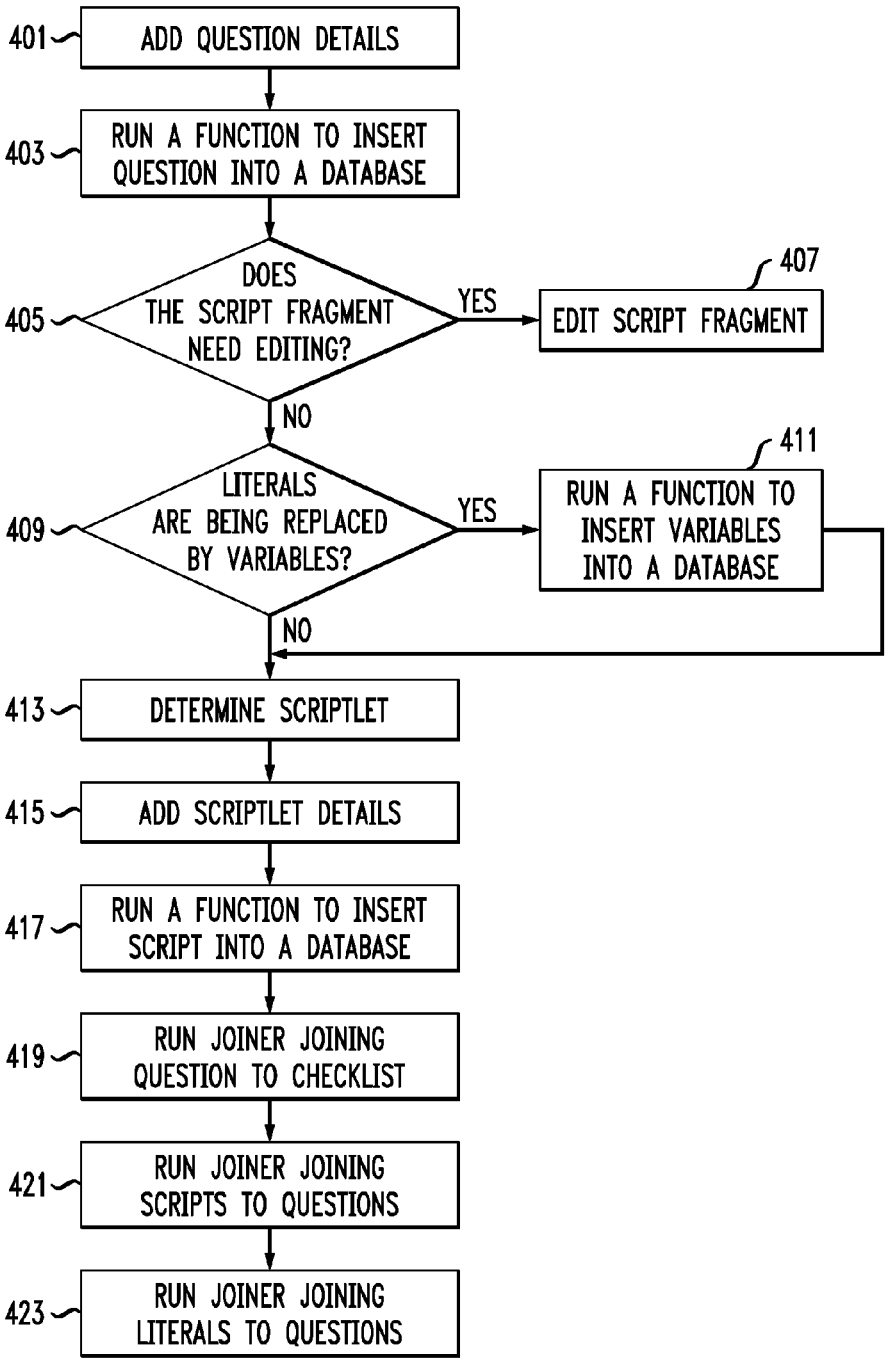
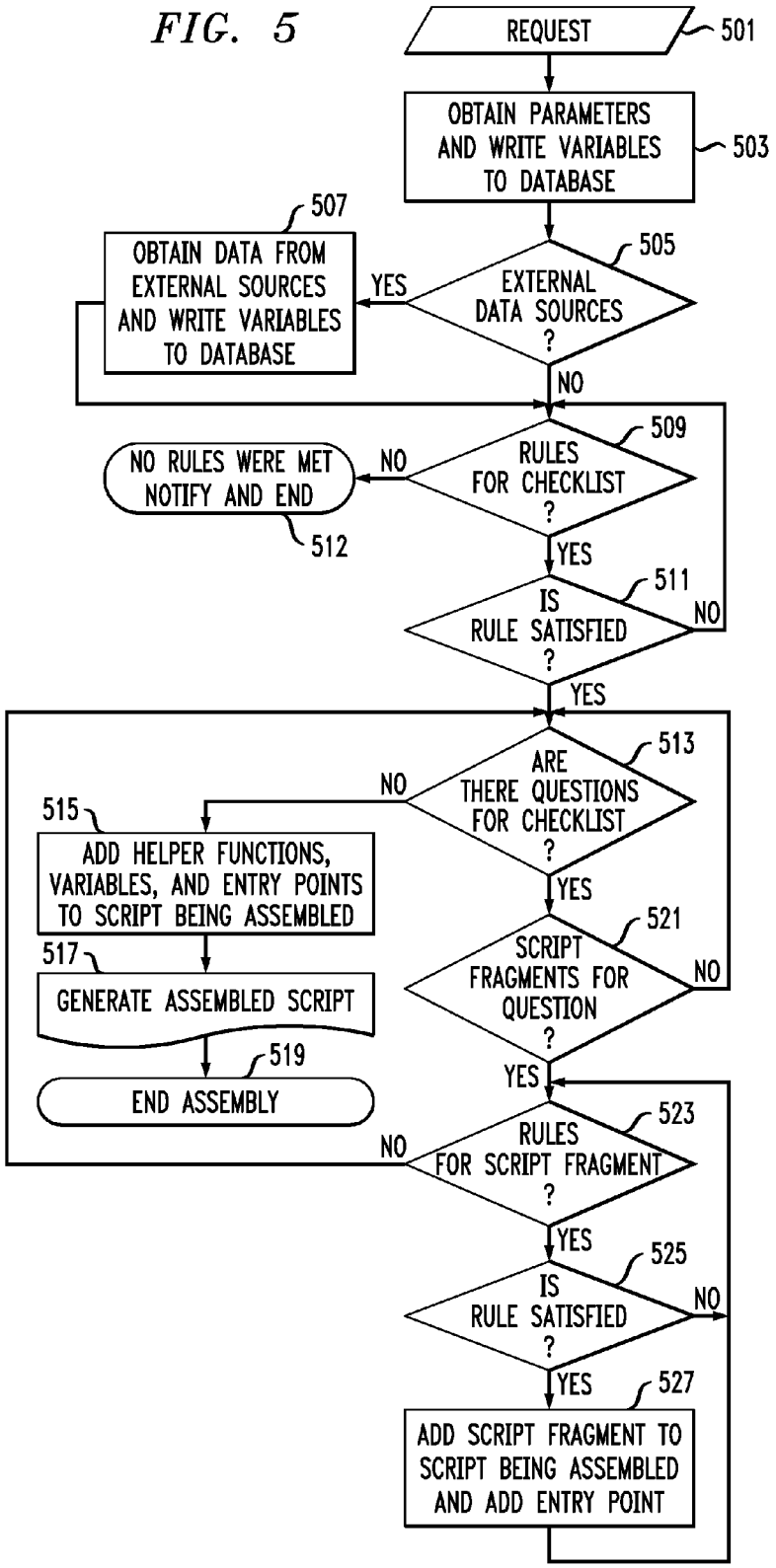

401
ADD QUESTION DETAILS
403
RUN A FUNCTION TO INSERT QUESTION INTO A DATABASE
405
DOES THE SCRIPT FRAGMENT NEED EDITING?
YES
407
EDIT SCRIPT FRAGMENT
NO
409
LITERALS ARE BEING REPLACED BY VARIABLES?
YES
411
RUN A FUNCTION TO INSERT VARIABLES INTO A DATABASE
NO
413
DETERMINE SCRIPTLET
415
ADD SCRIPTLET DETAILS
417
RUN A FUNCTION TO INSERT SCRIPT INTO A DATABASE
419
RUN JOINER JOINING QUESTION TO CHECKLIST
421
RUN JOINER JOINING SCRIPTS TO QUESTIONS
423
RUN JOINER JOINING LITERALS TO QUESTIONS

FIG. 5


REQUEST
501
OBTAIN PARAMETERS AND WRITE VARIABLES TO DATABASE
503
EXTERNAL DATA SOURCES ?
505
YES
OBTAIN DATA FROM EXTERNAL SOURCES AND WRITE VARIABLES TO DATABASE
507
NO
RULES FOR CHECKLIST ?
509
NO
NO RULES WERE MET NOTIFY AND END
512
YES
IS RULE SATISFIED ?
511
NO
YES
ARE THERE QUESTIONS FOR CHECKLIST ?
513
NO
ADD HELPER FUNCTIONS, VARIABLES, AND ENTRY POINTS TO SCRIPT BEING ASSEMBLED
515
YES
SCRIPT FRAGMENTS FOR QUESTION ?
521
NO
GENERATE ASSEMBLED SCRIPT
517
YES
END ASSEMBLY
519
RULES FOR SCRIPT FRAGMENT ?
523
NO
YES
IS RULE SATISFIED ?
525
NO
YES
ADD SCRIPT FRAGMENT TO SCRIPT BEING ASSEMBLED AND ADD ENTRY POINT
527

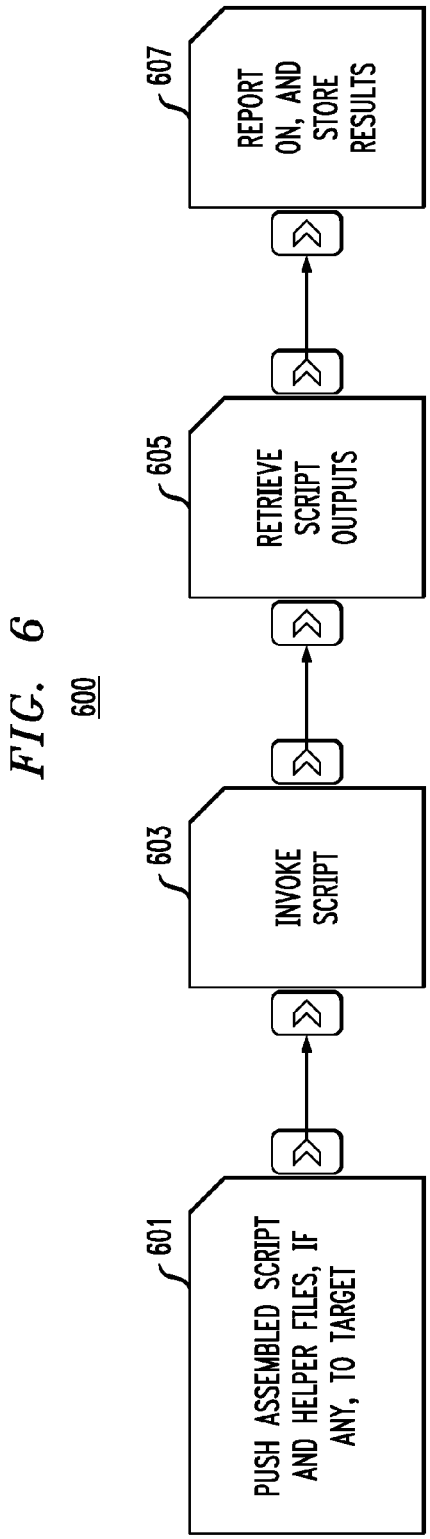

601
PUSH ASSEMBLED SCRIPT AND HELPER FILES, IF ANY, TO TARGET
603
INVOKE SCRIPT
605
RETRIEVE SCRIPT OUTPUTS
607
REPORT ON, AND STORE RESULTS

FIG. 6

600

FIG. 7

700

```
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Linux_q2_3()
{
shc_1line_question_html "$Linux_q2_3_lit_01"
if [ -f /etc/login.defs ]
then
      shc_1line_output_description_html "$Linux_q2_3_lit_02"
      shc_compliant_status_html
      complcount=`expr $complcount + 1`

      min_age=`grep ^PASS_MIN_DAYS /etc/login.defs`
      set -- $min_age
      min_age=$2
      if [ $min_age -eq $Linux_q2_3_lit_03 ]
        then
             shc_1line_output_description_html "$Linux_q2_3_lit_04"
             shc_compliant_status_html
             complcount=`expr $complcount + 1`
        else
             echo "$Linux_q2_3_lit_05" >> /tmp/Non-Compliant-List.$$
             shc_1line_output_description_html "$Linux_q2_3_lit_05"
             shc_non_compliant_status_html
             noncomplcount=`expr $noncomplcount + 1`
        fi
             rm -f /tmp/q2_3.$$
      done
else
        echo "$Linux_q2_3_lit_07" >> /tmp/Non-Compliant-List.$$
        shc_1line_output_description_html "$Linux_q2_3_lit_07"
        shc_non_compliant_status_html
        noncomplcount=`expr $noncomplcount + 1`
fi
}
```
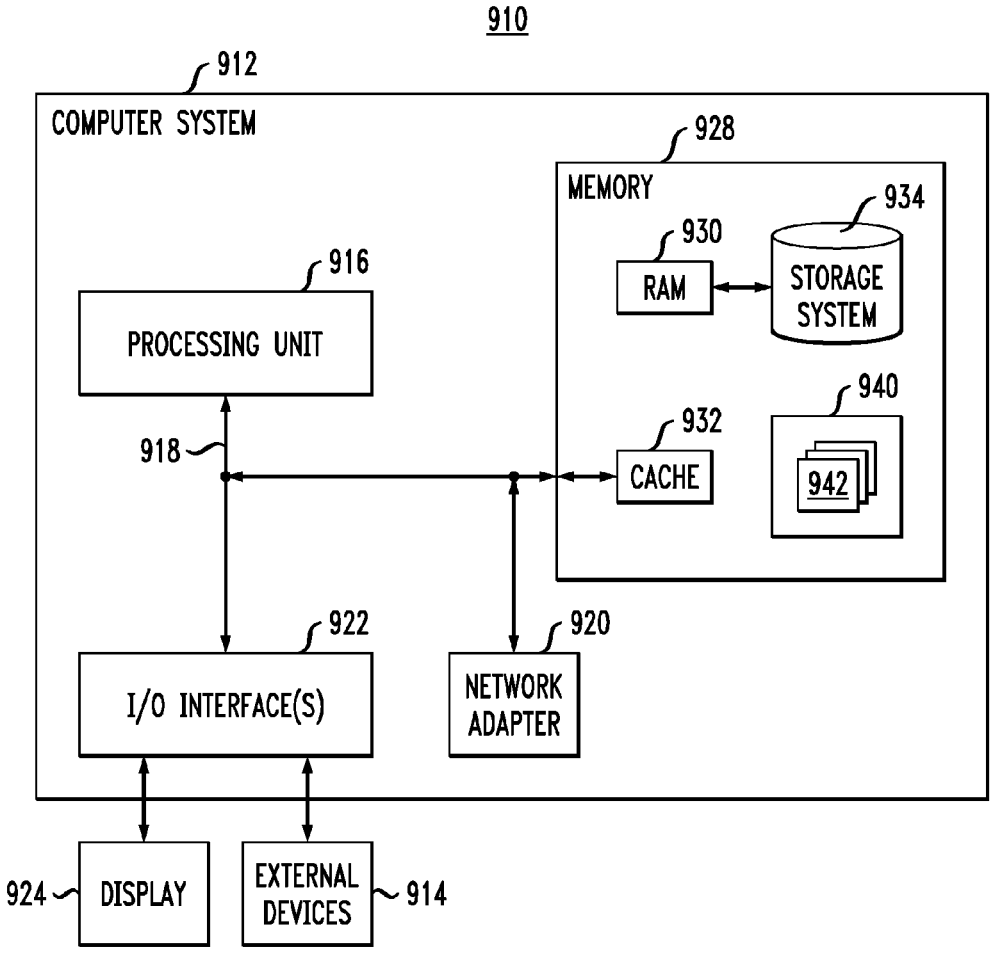

FIG. 8

800

Q 1.1 Userid	*Executed on pool07*
UNIQUE UIDs	COMPLIANT
Q 2.1 Authentication Script	*Executed on pool07*
PASSWORDS SET AT 90 DAYS.	COMPLIANT
USER: ROOT PASSWORD EXPIRATION NOT SET AT 90	COMPLIANT – GLOBAL EXCEPTION FOR CLOUD
Q 2.3 Minimum Password Age	*Executed on pool07*
/etc/login.defs FILE EXISTS	COMPLIANT
PASSWORD MINIMUM AGE SET AT 1 DAY.	COMPLIANT
Q 2.4 Parameter of pam_unix.so	*Executed on pool07*
Q 3.1 Check for /etc/motd – BUN	*Executed on pool07*
/etc/motd or /etc/issue IS PRESENT	COMPLIANT
Q 3.2 Checking for HOME directories for all users and Global umask	*Executed on pool07*
USER: ROOT HOME DIRECTORY /root WITH CORRECT PERMISSION	COMPLIANT
USER: TEST HOME DIRECTORY /home/test WITH CORRECT PERMISSION	COMPLIANT
GLOBAL UMASK SETTING IN /etc/bashrc IS CORRECT	COMPLIANT
Q 4. Information protection and confidentiality – password	*Executed on pool07*
FILE DOES NOT EXIST	NON COMPLIANT
Q 5.1 File/Directory Permissions	*Executed on pool07*
PERMISSIONS SET PROPERLY ON /	COMPLIANT
PERMISSIONS SET PROPERLY ON /usr	COMPLIANT
PERMISSIONS SET PROPERLY ON /etc	COMPLIANT

FIG. 9


910
912
COMPUTER SYSTEM
928
MEMORY
934
930
RAM
STORAGE SYSTEM
916
PROCESSING UNIT
940
932
CACHE
942
918
922
920
I/O INTERFACE(S)
NETWORK ADAPTER
924
DISPLAY
EXTERNAL DEVICES
914

SERVER VALIDATION WITH DYNAMIC ASSEMBLY OF SCRIPTS

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TECHNICAL FIELD

The field generally relates to systems and methods for managing computing utilities and, in particular, systems and methods for computer automated validation of server configurations.

BACKGROUND

Recently, there appears to have been a shift from the de-centralization of information processing to increased platform centralization and platform management, as well as a renewed interest in computing as a utility. These trends are illustrated by efforts to centrally manage grid computing facilities, in what appears to be a rising popularity of virtualization products, and an emphasis on cloud computing. Each of these technologies attempt to execute a migration of workloads to platforms where the workloads may be the most efficiently managed and the most effectively executed. The rationale behind these technologies is generally one of cost savings.

SUMMARY

In general, exemplary embodiments of the invention include systems and methods managing computing utilities and, in particular, systems and methods for computer automated validation of server configurations.

Embodiments of the present invention describe server-side composition of scripts, which will be executed on a client. In accordance with embodiments of the present invention, scripts are assembled for delivery to and execution by a client. The scripts that are assembled are capable of being delivered to, and executed in the client environment, not in the server environment. Accordingly, the assembly engine is cognizant of the operating system and other characteristics of the client device and assembles its scripts appropriately. For example, scripts that are assembled for execution on Windows® clients are written in a language that can be executed on Windows® platforms, while scripts assembled for execution on a UNIX® system are written in a language which can be executed on a UNIX® platform. Further, in accordance with embodiments of the present invention, the script functions that are assembled for delivery are assembled in a specific order.

Embodiments of the present invention provide methods for passing information between script functions once they are assembled, and for dynamically inserting commands to execute the script functions into the script during the assembly process, so that a client can eventually execute a downloaded script.

According to an exemplary embodiment of the present invention, a method for validation of a target environment, comprises assembling a validation script from a plurality of script fragments, inserting the assembled validation script into the target environment, executing the validation script in the target environment, gathering results of the executing, and reporting the results to at least one user.

According to an exemplary embodiment of the present invention, a system for validation of a target environment, comprises a validation module capable of assembling a validation script from a plurality of script fragments, and inserting the assembled validation script into the target environment, a target module capable of executing the validation script in the target environment, wherein the validation module is further capable of gathering results of the executing, and a reporting module capable of reporting the results to at least one user.

According to an exemplary embodiment of the present invention, a computer program product for server validation, comprises a computer readable storage medium having program instructions embodied therewith, the program instructions executable by a processor to cause the processor to perform a method comprising assembling a validation script from a plurality of script fragments, inserting the assembled validation script into a target environment, executing the validation script in the target environment, gathering results of the executing, and reporting the results to at least one user.

These and other embodiments of the invention will become apparent from the following detailed description of illustrative embodiments thereof, which is to be read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the present invention will be described below in more detail, with reference to the accompanying drawings, of which:

FIG. **1** is a block diagram of an automated server configuration validation system, according to an exemplary embodiment of the present invention.

FIG. **2** is a steady state message sequence diagram, according to an exemplary embodiment of the present invention.

FIG. **3** is an entity relationship schema showing the data entities used in accordance with exemplary embodiments of the present invention.

FIG. **4** is a flowchart diagram illustrating administrative steps to populate a library of reusable script fragments, according to an exemplary embodiment of the present invention.

FIG. **5** illustrates a flow diagram for assembly of a script, according to an exemplary embodiment of the present invention.

FIG. **6** illustrates a process flow performed after script assembly, according to an exemplary embodiment of the present invention.

FIG. **7** is a sample of a script fragment, according to an exemplary embodiment of the present invention.

FIG. **8** is an excerpt from a validation result report, according to an exemplary embodiment of the present invention.

FIG. **9** illustrates a computer system that may be used to implement one or more components/steps of the techniques of the invention, according to an exemplary embodiment of the invention.

DETAILED DESCRIPTION

Exemplary embodiments of the invention will now be discussed in further detail with regard to systems and

methods for managing computing utilities and, in particular, to systems and methods for computer automated validation of server configurations. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein.

Time Sharing Service Bureaus provided a form of what is referred to as a Platform As A Service (PAAS), providing an infrastructure whose cost could be shared across customers such that the cost to each customer might be less than the cost of independent ownership.

Grid computing utilizes computer resources from a plurality of administrative domains to reach a common goal, and attempts to reduce cost by increasing efficiency. Grid computing takes advantage of available computing resources, which are not being used, and incorporates the unused resources into a network in which workloads could be appropriately placed as computing resources become available.

Virtualization is an enabling technology designed to assist in the migration of a workload to a more centralized, more efficiently managed platform. Cloud computing delivers computing as a service, providing shared resources, software, and information to computers and other devices over a network. Cloud computing, therefore, is another vehicle providing an infrastructure whose cost can be shared across customers, so that the cost to each customer may be less than the cost of independent ownership.

In order to realize the potential benefits offered by increased platform centralization and centralized platform management, existing workloads must be migrated into those environments including the more efficiently managed platforms. The migration process involves various steps, including, but not necessarily limited to: (a) thoroughly understanding an existing source environment; (b) evaluating target platforms with regard to their ability to sustain workloads; (c) customizing the target systems, as needed, to accept workloads; (d) performing a validation process of a target platform configuration to ensure that security risks are mitigated and that the platform is configured to meet requirements; (e) providing a mechanism to move a workload to a target platform; and (f) performing a further validation to ensure that a workload functions properly in its new environment.

The step (d) of validating a target platform configuration may be complex and very time consuming since, for example, requirements may vary from customer to customer and workload to workload, and may change over time. In addition, the step (d) may rely on systems administrators to run a variety of operating system commands and other systems management tools, capturing screenshots of outputs, making declarations that necessary tasks been performed and attesting to their results. These results may be subject to review by auditing agencies in order to assure compliance with contractual agreements. In some instances, the step (d) can take days or weeks to complete, and the results may ultimately be inaccurate. Therefore, in order to improve the timeliness and accuracy with which computing utility services may be realized, embodiments of the present invention provide methods and systems for automating target server configuration validation.

In accordance with an embodiment of the present invention, a system dynamically invokes external agencies to supply any required data that is unavailable to a local system, and merges this data into a validation script. The required data includes, but is not necessarily limited to, registration of the target server with inventory management systems, with security scanning systems, results of security scans, frequency of security scans, and registration of user accounts with account maintenance systems. The validation script is dynamically assembled from a library of re-usable script fragments appropriate to the characteristics of target servers, and which are also appropriate to stated requirements of the customer at hand. Additionally, the system inserts the assembled script(s) into the target server, executes the scripts, gathers the results, stores information about the validation attempt in a repository, generates reports, and notifies a list of users and management systems as to the validation attempt results.

Configuration policies refer to policies that describe an agreement between customers and service providers as to the specifics of server configurations. Validation of a target platform configuration, in accordance with an embodiment of the present invention, ensures that a provisioned server meets specific and contractually agreed upon configuration policies. Policies may vary within a customer account, per geography, per department, or per any other criteria that has been agreed upon by the customer and service provider. For example, a customer might require passwords to be 8 characters long for servers in a first geographical region, and 10 characters long for servers in a second geographical region. Such policies might be effectively expressed as scripts, which incorporate parameterization to avoid unnecessary duplication of scripts.

In some cases, the steps which must be taken to validate configuration parameters will vary between platforms. For example, a relatively simple example of a subset of the validation tasks might include validating a minimum user account password length enforced by a system. To perform this validation on, for example, a Linux® operating system, a systems administrator may need to issue the command "grep^PASS_MIN_LEN/etc/login.defs", print the results to an output file or capture the terminal display results, and include those outputs and results in a document showing evidence of compliance validation. For Windows® 2008 systems, the minimum password length enforcement may be validated by executing a "net accounts" command, parsing the output to find the value prefaced by "Minimum password length:", and capturing and reporting the results. For AIX® systems, a minimum password length enforcement may be validated by executing the command "lsuser" per user, finding the "minlen" stanza, and capturing and reporting the results. Each of these three operating systems has a unique way of obtaining the minimum password length enforced on the server. Embodiments of the present invention are configured to handle steps for validating configuration parameters that vary between platforms.

In other cases, the steps which must be taken to validate configuration parameters, may be shared between all platforms. For example verifying the registration of a target server with other management systems may require invocation of a secondary process, which interrogates an external database as to the registration status of the target server, retrieves the results, and reports the results, all of which steps can be indifferent to the target server platform specifics. Embodiments of the present invention are configured to handle steps for validating configuration parameters that are shared between platforms.

In some cases, identical steps, which must be taken to validate configuration parameters, may be shared between a subset of generally similar, but not identical, platforms. For example, Linux® and AIX® are both variants of the UNIX® operation system. Linux® and AIX® may share a common step to validate whether they permit empty passwords by issuing a generic Unix® command 'grep"^PermitEmptyPas-

swords"/etc/ssh/sshd_config|awk'{print $NF}'", retrieving, parsing, and reporting the results. There is no need to duplicate this step between Linux®, AIX®, and other UNIX® systems, and it may be re-used. Embodiments of the present invention are configured to recognize where steps for validating configuration parameters can be re-used.

Embodiments of the present invention are configured to address several dimensions of complexity. For example, validation steps may be invoked in a certain sequence that reflects a variety of customer policies, and may be affected by variations between platforms. Some validation steps might potentially be common across all platforms, but may need to be tailored to accommodate varying customer policies. Some validation steps might be common within general platform families, or may be specific to platforms, but common across customer implementations. Because there are affinities and compatibilities between families of platforms and other software, embodiments of the present invention recognize that the mechanics of validation steps can often be shared across varying platforms and other software.

Validation policies may vary along many axes including, but not limited to, customers, geographies, operating systems, and installed middleware. In order to improve the timeliness and accuracy with which computing utility services may be realized, embodiments of the present invention provide methods and systems to more fully automate server configuration validation, which increases flexibility, encourages the use of parameterization, and which facilitates the sharing and re-use of validation steps.

According to embodiments of the present invention, an automated server configuration validation system and method are described, including an administrative procedure, a preparatory procedure, and a steady-state operational procedure. The administrative procedure includes steps such as defining customer account information, specifying desired report layouts and media, and defining report recipients. The preparatory procedure includes a phase in which a library of script fragments is created, and in which external and internal data variables are declared. The preparatory procedure also includes another phase in which customer requirements are codified as a set of questions, which are to be answered by a selection of script fragments to be executed in a specified relative order, and in which data variables are associated with the selected script fragments. This phase may also include associating data variables with external functions, which may populate the data variables.

In accordance with embodiments of the present invention, during the operational procedure, when the system is invoked, it is given a reference to a target environment to be validated. The target environment includes, for example, a target server and any other platform configured to run a workload. The system obtains any required variable information related to the target environment (e.g., target server) from external sources and stores that information as declared in the preparatory phase. The variable information includes, but is not necessarily limited to, registration of the target server with inventory management systems, with security scanning systems, results of security scans, frequency of security scans, and registration of user accounts with account maintenance systems. The system then dynamically assembles validation scripts from a library of re-usable script fragments as appropriate to the characteristics of the target environment (e.g., target server), and as appropriate to the stated policies of the customer concerned, as codified in the preparatory procedure. As part of the script assembly, the system prepares and includes script variable definitions based on any required variable data stored in the prior step. This provides a means to pass information from external sources to the assembled script. The system then inserts the assembled script(s) into the target server, executes the script(s), gathers the results, stores information about the validation attempt in a repository, generates reports, and notifies a list of users and management systems as to the validation attempt results.

In accordance with an embodiment of the present invention, an understanding of the general configuration of a target server can be assumed and may be input as additional criteria for the selection and assembly of appropriate script fragments. The understanding of the general configuration of the target server may be obtained from any of a variety of well-known configuration discovery and management techniques. In an embodiment, representations of high-level configurations of target servers are stored in a database. This information may be used at a high level to help drive the conditional assembly of script fragments based on a target server's operating system. At a finer level, this information may be used to help drive the conditional assembly of scripts addressing specific middleware. The dynamic conditional assembly of script fragments may be influenced by additional factors, such as the owning customer, the geographic location of the target server, and local legal requirements.

FIG. **1** illustrates a block diagram of a system for validation of a server configuration, according to an exemplary embodiment of the present invention. The system **100** includes a database **103**. In administrative and preparatory phases, a preparatory module **102**, based on input from script authors and/or administrators **101**, creates and populates the database **103** with, for example, script fragments, rules for assembling the script fragments, references to external processes, variables, questions, checklists, joins (relationships) and customer account policies. A use or triggering event **105** from a requesting entity, such as, for example, a validation request, triggers the validation module **107** (e.g., a validation server) to invoke external processes, if any, from external management systems **109**, and to assemble a validation script from script fragments from the database **103**. The validation module **107** transfers and inserts the assembled script to a target module **111** (e.g., a target environment/server), and records execution of the script on the target module **111**. The validation module gathers the results of the execution on the target module **111**, transmits the results to a reporting module **113** (e.g., an email server), which provides result reports **115** to designated users.

The system **100** further includes a repository **104** for information about a validation request, such as, for example, who made the request, when was the request made, who owns the server from which the request originated and what account does the server belong to. A repository **104** also includes specifications for a target server(s), which may be built or provisioned, including, for example, the operating system of the server(s), user accounts, file systems, disks, network addresses, and middleware.

The validation module is further capable of determining that the script fragments correspond to characteristics of the target environment, and of invoking an external source to supply the characteristics of the target environment. The validation module **107** is also capable of declaring a plurality of data variables in the script fragments, and populating the data variables with values obtained from an external source.

The validation module **107** also codifies a plurality of customer requirements as a set of questions, and uses one or

more of the script fragments to answer the set of the questions. In accordance with an embodiment of the present invention, the validation module **107** obtains parameters for the validation script and writes variables to a database, queries whether any checklist rules correspond to one or more of the variables, and scopes the variables at least one of globally, to a checklist and to a request. When a checklist rule corresponds to one or more of the variables, the validation module **107** queries whether the checklist rule has been satisfied, and selects a checklist having the satisfied checklist rule.

Communications between components of the system **100** can be performed via a network, such as, for example, a local area network (LAN), wide area network (WAN), cellular network, satellite network or the Internet.

FIG. **2** illustrates message flows **200** during an operational phase, according to an exemplary embodiment of the present invention. FIG. **2** includes blocks for a requester **205**, validation server **207**, external management systems **209**, target server **211**, and e-mail server **213**, which correspond to similarly numbered elements of system **100** in FIG. **1**. A validation request **250** is sent from requester **205** to validation server **207**. The validation server **207** sends external queries **252** to external management systems **209**, which provide a response(s) to the external queries **253** back to the validation server **207**. The external queries include, for example, request for information from the external systems to put in scripts, including, but not limited to, script parameters such as, customer account ids, geography and middleware installed on a target.

The validation server **207** sends a request to copy the validation server public key **254** to the target server **211**, and receives a response to the request **255** from the target server **211**. With this exchange, the validation server **207** is addressing security concerns, such as obtaining the authority to push scripts out to and execute those scripts on the target server **211**. The validation server **207** pushes assembled scripts **256** to and invokes scripts **258** on the target server **211**, and receives acknowledgement **257**, **259** from the target server **211** that a pushed script has been received and a script has been invoked.

The validation server sends a request for script outputs and clean-up of temporary files **260** to the target server **211**, and receives, via a file transfer mechanism, script outputs **261** from the target server **211**. The validation server **207** sends a response message **270** to the requester **205** regarding the status of the validation request **250** and any script outputs **261**.

The requester **205** sends a request for the activation status **280** to the validation server **207**, and the validation server **207** sends a request **282** to the e-mail server **213** to email the script and external database results to the contacts. The e-mail server **213** sends a response **283** to the request back to the validation server **207**. The response includes an indication that the e-mail to the contacts has been sent, or that there has been a problem with sending the e-mail.

The validation server **207** sends notifications **284** to external management systems **209**. The notifications may include, for example, problems with the activation and/or validation. The external management systems **209** respond to the notifications **285**, and a response message **290** including, for example, the activation status, is sent from the validation server **207** to the requester **205**.

FIG. **3** illustrates a schema **300** of the database **103**, according to an exemplary embodiment of the present invention. The schema **300** includes a location for details of a request **301**, which includes storage areas for a universally unique identifier (uuid) and server_config_id, a location for target Server_Config_X_Software **303**, which includes storage areas for server_config_id and software_id, a location for Software **309** of a target, which includes storage areas for uuid, class, operating system class (osclass), name and version, and a location for Software_X_Software **311**. In brief, the locations **301**, **303**, **309** and **311** include an operating system and middleware for a target environment. In accordance with an embodiment of the present invention, operating systems and middleware are contained in the same database table (called Software). Software_X_Software is a join table used to express the relationships between various softwares. For example, a software Windows® 2008 and a software Word® 2003 can be permitted to be linked to each other, expressing a relationship: table1=software, value1=Windows 2008, table2=software, value2=Word 2003.

The schema **300** further includes a location for account holder details **305**, which includes storage areas for ID, name, created and updated, a location for geographical information **307**, which includes storage areas for ID, description, account_id, created and updated, a location for Presentation_Properties **313**, which includes storage areas for uuid, account_id, geo_id, description, distribution_list_id, report_attributes_id, created and updated, and a location for Report_Atrributes **315**, which includes storage areas for uuid, heading1, heading2, footer1, footer2, file1_prefix, file2_prefix, created and updated. Presentation properties describe what metadata should go into a report, and report attributes describe how to format information in a report back to a user.

The schema further includes a template area **320**, which includes a location for checklist data **321**, which includes storage areas for checklist_id, description, geo_id, presentation_properties_id, created and updated, a location for join data **323**, which includes storage areas for join_id, step, table1, table2, value1, value2, created and updated, a location for question data **325**, which includes storage areas for question_id, name, description, text, created, updated, rules, rule_id, checklist_id, rule, created and updated, and a location for scripts data **324**, which includes storage areas for script_id, description, body, name, class, software_name, software_version, created, updated and subclass. The template area **320** further includes a location for NEWSAND.Request **327**, which includes storage areas for request_id, ip_address, state, checklist_id, external_request_id, hostname, created and updated, a location for Globals **326**, which includes storage areas for global_id, checklist_id, name, value, type, state, request_id, created and updated, a location for rules **322**, which includes storage areas for rule_id, checklist_id, rule, created and updated, and a location for variables **328**, which includes storage areas for literal_id, name, text, class, software_name, software_version, created and updated. NEWSAND.Request refers to a database table that has a row for every validation request that is entered. Globals are variables that are associated with an entire checklist, rather than with a specific question.

With reference to FIG. **3**, customer account information, policies, contact information, and reporting preferences are stored in a database. Script fragments are stored in a database and contain, for example, a name, an id, the script fragment content, and information regarding the script fragment's appropriate usage, such as platform types with which it is compatible, and which categories of function it addresses.

References to external functions, which are invoked to retrieve and store data into variables, are stored in the

database and used to drive the population of variables as needed. These references include such information as execution path and execution file name. Variables are stored in a database and contain, for example an id, content in string form, an indication as to the content type of the variable, such as "string" or "integer", an indication as to whether the variables are scoped globally, scoped per checklist, or scoped per request instance, or scoped to some other context. The scoping of a variable refers to the contexts to which a variable instance applies. A globally scoped variable maintains a single instance whose value may be referenced from any script fragment. A variable that is scoped to a checklist maintains an instance per checklist, which may be referenced only from within the specified checklist. A variable scoped to a request instance may contain a unique value per request instance.

In a non-limiting illustrative example, a variable, SCAN_FREQ, might be used to pass information regarding security scanning frequency from an external function that manages security, to the script for eventual reporting, by means of variables in the database. In accordance with an embodiment of the present invention, the security scanning frequency variable is updated each time the validation scripts are prepared for a particular target server. For example, if there are three different target servers for which three different requests have been prepared, three instances of the SCAN_FREQ variable are stored into the database.

The script fragment might contain:

outline=outline & "Server found in scan schedule, frequency is:" & SCAN_FREQ which concatenates the declared value of SCAN_FREQ in the script with the string "Server found in scan schedule, frequency is:" and places the result in a script variable named outline. During script assembly, an external service associated with the SCAN_FREQ variable is invoked for the current request, and a value is returned and placed into the variable table of the database. The variables appropriate to the request are then assembled into the script, which is being prepared by the system.

Continuing with the non-limiting illustrative embodiment, a variable table in the database can contain three rows (one for each of three requests that have been initiated):

SCAN_FREQ instance 1, value "annually", scoped to request 1 (server 9.2.3.4);

SCAN_FREQ instance 2, value "biennially", scoped to request 2 (server 9.5.6.7); and

SCAN_FREQ instance 3, value "weekly", scoped to request 3 (server 9.9.8.25).

The assembled script for request 2 can contain:

SCAN_FREQ="biennally"

outline=outline & "Server found in scan schedule, frequency is:" & SCAN_FREQ

In accordance with an embodiment of the present invention, if request 2 is re-run at a later time, the external service can report a different value for SCAN_FREQ for request 2 (server 9.5.6.7). Embodiments of the present invention allow reporting the different value, but also maintain the contextual integrity of SCAN_FREQ instances 1 and 3 as well, which is accomplished by scoping the variable to the request/target server.

The assembled script for request 2 can now contain:

SCAN_FREQ="monthly"

outline=outline & "Server found in scan schedule, frequency is:" & SCAN_FREQ

According to an embodiment of the present invention, questions are stored in a database and contain an id, a name, and a description. By using a generic join table, customer policies are joined with questions, script fragments, and variables. This can provide more flexibility than explicit use of foreign key relationships within joined tables. By using a generic external join table, a level of indirection is introduced, which provides greater flexibility. For example, tables can be joined dynamically without making schema changes if relationships between tables are added or removed.

FIG. **4** illustrates a flow diagram for a method of populating a library of script fragments, according to an exemplary embodiment of the present invention. In accordance with an embodiment of the present invention, questions, scripts, literals, and the joins of these items are performed via, for example, a web user interface (UI) to create, update, and delete these items, and to gather object details such as names, script file paths, values, etc. Alternatively, in a batch load option, questions, scripts, literals, and the joins of these items are performed by running programs, for example, JAVA® programs, that read comma separated values (CSV) files to gather object details such as names, script file paths, values, etc. Questions are joined to checklists, scripts are joined to questions, and literals are joined to questions. Variables can refer to values that are not known until runtime, and are associated with specific questions, while literals can refer to constants having a pre-defined fixed value that are associated with specific questions. The join of scripts to questions specifies a relative order of execution of the scripts, in a step column.

The method **400** includes adding question details **401**, running a function (e.g., PutQuestion) to insert the question into a database **403**, and evaluating a script fragment to determine whether the script fragment needs editing **405**. If yes, the method proceeds to block **407**, where the script fragment is edited. For example, if literals should be replaced by variables, this is performed, and literal details are written to the database. Literals can be replaced with variables, and variables can be populated with values read from the database at the time of script assembly.

If no at block **405**, a query is made at block **409** whether literals are being replaced by variables? If yes, at block **411**, a function (e.g., PutLiteral) is run to insert the variables into the database. If no at block **409**, the method proceeds to block **413** where a scriptlet step is determined, and to block **415** where scriptlet details are added to the database. At block **417**, a function (e.g., PutScript) is run to insert the script into the database. At blocks **419**, **421** and **423**, joiners are run to join questions to checklists, scripts to questions, and literals to questions.

FIG. **4** describes a process of developing or customizing scriptlets and loading them into a repository. When doing this it may be necessary to declare literals, to declare variables, to add the scriptlet itself to the inventory, and to describe when the scriptlet should be invoked, and under what circumstances. According to an embodiment, population of the database elements, which will drive the script assembly, is performed during the administrative and preparatory phases. During the operational phase, the database may also be used to retain information regarding a validation attempt. Such information might include history information such as timestamps, target server ids, and completion status.

FIG. **5** illustrates a flow diagram for assembly of a script, according to an exemplary embodiment of the present invention. In general, a validation request is accepted as input, appropriate target servers are identified, external sources are interrogated for additional required information, if any, and script assembly is performed as appropriate to the

target server operating system (OS). The assembled script is pushed to the target server, invoked, and its outputs are retrieved, and reported.

The method **500** includes receiving a validation request **501**, for example, a user request, and obtaining parameters for the script and writing variables to a database **503**. For example, script parameters and values are written to a variables table in the database. Script parameters can include, for example, customer account id, geography (e.g., from the request) and middleware installed on a target.

At block **505**, it is queried whether at least some of the script parameters are to be obtained from external data sources. If yes, at block **507**, the data from external sources is obtained and variables based on the data from the external sources are written to a database (e.g., written to variables table). Variables can be scoped globally, to a checklist, and to a request. In addition, variables can be defined per the target OS scripting language.

If no at block **505**, the method proceeds to block **509**, where it is queried whether there are any checklist rules that correspond to one or more variables for the request. For example, a checklist is selected for the validation attempt that is appropriate to the target server's customer, account, geography, middleware and/or software. If there is no hit at block **509**, then a given checklist is removed from the candidate list, and the process moves to the next checklist to see if any rules for that checklist correspond to variables of the request. If a rule is found at block **509**, then it is queried at block **511** whether the checklist rule that corresponds to a variable for the request is satisfied. If the rule is not satisfied at block **511**, the method returns to block **509** to look for additional checklist rules that correspond to one or more variables for the request. If no rules are satisfied at block **511**, and no more checklist rules correspond to variables for the request, the method proceeds to block **512**, where it is determined that no rules were met, a user is notified of this result, and the process ends.

If a rule is satisfied at block **511**, a checklist is selected, and the method proceeds to block **513**. For example, in a non-limiting illustrative embodiment, A, B are exemplar queries for checklist 1. A) 1:name='Account' and value='IGA'; B) 1:name='Geography' and value='NA'. If both A and B are met at block **511**, then select Checklist 1, and proceed to block **513**.

At block **513**, it is queried whether there are outstanding checklist questions that must be addressed, in other words, has the checklist been completed? If no outstanding checklist questions (i.e., the checklist has been completed), then the method proceeds to blocks **515**, **517** and **519**, where helper functions, variables and entry points are appended to an output script, the assembled script is generated, and the assembly process ends. Non-helper functions can also be appended to an output script, with a list of the non-helper function names being added to an array and appended to the output script. Trailer helper functions, which perform post-processing functions such as, for example, clean-up of temporary files on a target, can also be appended to an output script.

If it is determined that there are questions for a checklist (i.e., the checklist has not been completed) at block **513**, then the method proceeds to blocks **521**, **523** and **525**, where it is determined whether and what script fragments are needed based on responses to questions in the checklist. For example, the checklist may inquire as to the nature of the target OS, and if the target OS is a Linux® variant, a UNIX® script can be assembled out of variables and script fragments determined by responses to additional checklist questions. If the target OS is a Windows® variant, a Windows® script can be assembled out of variables and script fragments determined by responses to additional checklist questions.

Referring to block **521**, it is determined whether any script fragments correspond to the questions for the checklist, and if so, at block **523** whether there are any rules for those script fragments. If so, it is determined at block **525** whether those rules are satisfied, and, if a rule is satisfied, the corresponding script fragment is added to an output script and an entry point is added to a list. The list refers to a list of script fragments (e.g., functions) to be executed.

If it is determined at block **521** that no script fragments correspond to a question for the checklist, the method returns to block **513** to check if there are more questions. If it is determined at block **523** that there are no rules for a script fragment from block **521**, the method returns to block **521** to check if there are more script fragments. If it is determined at block **525** that a rule for a script fragment is not satisfied, the method returns to block **523** to check whether there are more rules. If it is determined at block **525** that a rule for a script fragment is satisfied, the method proceeds to block **527**, where the script fragment for which the rule is satisfied is added to the script being assembled and an entry point is added to the list.

The questions, variables, and script fragments associated with a checklist are retrieved by means of querying the database join tables and assembling the results (with appropriate scripting syntax) into an output script.

FIG. **6** illustrates a process flow performed after script assembly, according to an exemplary embodiment of the present invention. Referring to FIG. **6**, a method **600** includes pushing an assembled script and helper files, if any to the target server **601**, invoking the script **603**, retrieving the script outputs **605**, and reporting and storing the results of the script outputs **607**.

FIG. **7** illustrates a script fragment **700**, according to an exemplary embodiment of the present invention. FIG. **8** illustrates a portion of a validation report **800** according to an exemplary embodiment of the present invention. As can be seen in FIG. **8**, the report includes information on whether certain elements of a target platform meet requirements of a source environment. In accordance with an embodiment, the elements may correspond to identifiers, authentication, directories, confidentiality and permissions.

The present invention may be a system, a method, and/or a computer program product. The computer program product may include a computer readable storage medium (or media) having computer readable program instructions thereon for causing a processor to carry out aspects of the present invention.

The computer readable storage medium can be a tangible device that can retain and store instructions for use by an instruction execution device. The computer readable storage medium may be, for example, but is not limited to, an electronic storage device, a magnetic storage device, an optical storage device, an electromagnetic storage device, a semiconductor storage device, or any suitable combination of the foregoing. A non-exhaustive list of more specific examples of the computer readable storage medium includes the following: a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), a static random access memory (SRAM), a portable compact disc read-only memory (CD-ROM), a digital versatile disk (DVD), a memory stick, a floppy disk, a mechanically encoded device such as punch-cards or raised structures in a groove having instructions

recorded thereon, and any suitable combination of the foregoing. A computer readable storage medium, as used herein, is not to be construed as being transitory signals per se, such as radio waves or other freely propagating electromagnetic waves, electromagnetic waves propagating through a waveguide or other transmission media (e.g., light pulses passing through a fiber-optic cable), or electrical signals transmitted through a wire.

Computer readable program instructions described herein can be downloaded to respective computing/processing devices from a computer readable storage medium or to an external computer or external storage device via a network, for example, the Internet, a local area network, a wide area network and/or a wireless network. The network may comprise copper transmission cables, optical transmission fibers, wireless transmission, routers, firewalls, switches, gateway computers and/or edge servers. A network adapter card or network interface in each computing/processing device receives computer readable program instructions from the network and forwards the computer readable program instructions for storage in a computer readable storage medium within the respective computing/processing device.

Computer readable program instructions for carrying out operations of the present invention may be assembler instructions, instruction-set-architecture (ISA) instructions, machine instructions, machine dependent instructions, microcode, firmware instructions, state-setting data, or either source code or object code written in any combination of one or more programming languages, including an object oriented programming language such as Smalltalk, C++ or the like, and conventional procedural programming languages, such as the "C" programming language or similar programming languages. The computer readable program instructions may execute entirely on the user's computer, partly on the user's computer, as a stand-alone software package, partly on the user's computer and partly on a remote computer or entirely on the remote computer or server. In the latter scenario, the remote computer may be connected to the user's computer through any type of network, including a local area network (LAN) or a wide area network (WAN), or the connection may be made to an external computer (for example, through the Internet using an Internet Service Provider). In some embodiments, electronic circuitry including, for example, programmable logic circuitry, field-programmable gate arrays (FPGA), or programmable logic arrays (PLA) may execute the computer readable program instructions by utilizing state information of the computer readable program instructions to personalize the electronic circuitry, in order to perform aspects of the present invention.

Aspects of the present invention are described herein with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems), and computer program products according to embodiments of the invention. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer readable program instructions.

These computer readable program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks. These computer readable program instructions may also be stored in a computer readable storage medium that can direct a computer, a programmable data processing apparatus, and/or other devices to function in a particular manner, such that the computer readable storage medium having instructions stored therein comprises an article of manufacture including instructions which implement aspects of the function/act specified in the flowchart and/or block diagram block or blocks.

The computer readable program instructions may also be loaded onto a computer, other programmable data processing apparatus, or other device to cause a series of operational steps to be performed on the computer, other programmable apparatus or other device to produce a computer implemented process, such that the instructions which execute on the computer, other programmable apparatus, or other device implement the functions/acts specified in the flowchart and/or block diagram block or blocks.

The flowchart and block diagrams in the Figures illustrate the architecture, functionality, and operation of possible implementations of systems, methods, and computer program products according to various embodiments of the present invention. In this regard, each block in the flowchart or block diagrams may represent a module, segment, or portion of instructions, which comprises one or more executable instructions for implementing the specified logical function(s). In some alternative implementations, the functions noted in the block may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. It will also be noted that each block of the block diagrams and/or flowchart illustration, and combinations of blocks in the block diagrams and/or flowchart illustration, can be implemented by special purpose hardware-based systems that perform the specified functions or acts or carry out combinations of special purpose hardware and computer instructions.

One or more embodiments can make use of software running on a general-purpose computer or workstation. With reference to FIG. **9**, in a computing node **910** there is a computer system/server **912**, which is operational with numerous other general purpose or special purpose computing system environments or configurations. Examples of well-known computing systems, environments, and/or configurations that may be suitable for use with computer system/server **912** include, but are not limited to, personal computer systems, server computer systems, thin clients, thick clients, handheld or laptop devices, multiprocessor systems, microprocessor-based systems, set top boxes, programmable consumer electronics, network PCs, minicomputer systems, mainframe computer systems, and distributed cloud computing environments that include any of the above systems or devices, and the like.

Computer system/server **912** may be described in the general context of computer system executable instructions, such as program modules, being executed by a computer system. Generally, program modules may include routines, programs, objects, components, logic, data structures, and so on that perform particular tasks or implement particular abstract data types. Computer system/server **912** may be practiced in distributed cloud computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed cloud computing environment, program modules may be located in both local and remote computer system storage media including memory storage devices.

As shown in FIG. **9**, computer system/server **912** in computing node **910** is shown in the form of a general-purpose computing device. The components of computer system/server **912** may include, but are not limited to, one or more processors or processing units **916**, a system memory **928**, and a bus **918** that couples various system components including system memory **928** to processor **916**.

The bus **918** represents one or more of any of several types of bus structures, including a memory bus or memory controller, a peripheral bus, an accelerated graphics port, and a processor or local bus using any of a variety of bus architectures. By way of example, and not limitation, such architectures include Industry Standard Architecture (ISA) bus, Micro Channel Architecture (MCA) bus, Enhanced ISA (EISA) bus, Video Electronics Standards Association (VESA) local bus, and Peripheral Component Interconnects (PCI) bus.

The computer system/server **912** typically includes a variety of computer system readable media. Such media may be any available media that is accessible by computer system/server **912**, and it includes both volatile and non-volatile media, removable and non-removable media.

The system memory **928** can include computer system readable media in the form of volatile memory, such as random access memory (RAM) **930** and/or cache memory **932**. The computer system/server **912** may further include other removable/non-removable, volatile/nonvolatile computer system storage media. By way of example only, storage system **934** can be provided for reading from and writing to a non-removable, non-volatile magnetic media (not shown and typically called a "hard drive"). Although not shown, a magnetic disk drive for reading from and writing to a removable, non-volatile magnetic disk (e.g., a "floppy disk"), and an optical disk drive for reading from or writing to a removable, non-volatile optical disk such as a CD-ROM, DVD-ROM or other optical media can be provided. In such instances, each can be connected to the bus **918** by one or more data media interfaces. As depicted and described herein, the memory **928** may include at least one program product having a set (e.g., at least one) of program modules that are configured to carry out the functions of embodiments of the invention. A program/utility **940**, having a set (at least one) of program modules **942**, may be stored in memory **928** by way of example, and not limitation, as well as an operating system, one or more application programs, other program modules, and program data. Each of the operating system, one or more application programs, other program modules, and program data or some combination thereof, may include an implementation of a networking environment. Program modules **942** generally carry out the functions and/or methodologies of embodiments of the invention as described herein.

Computer system/server **912** may also communicate with one or more external devices **914** such as a keyboard, a pointing device, a display **924**, etc., one or more devices that enable a user to interact with computer system/server **912**, and/or any devices (e.g., network card, modem, etc.) that enable computer system/server **912** to communicate with one or more other computing devices. Such communication can occur via Input/Output (I/O) interfaces **922**. Still yet, computer system/server **912** can communicate with one or more networks such as a local area network (LAN), a general wide area network (WAN), and/or a public network (e.g., the Internet) via network adapter **920**. As depicted, network adapter **920** communicates with the other components of computer system/server **912** via bus **918**. It should be understood that although not shown, other hardware and/or software components could be used in conjunction with computer system/server **912**. Examples, include, but are not limited to: microcode, device drivers, redundant processing units, external disk drive arrays, RAID systems, tape drives, and data archival storage systems, etc.

Although illustrative embodiments of the present invention have been described herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various other changes and modifications may be made by one skilled in the art without departing from the scope or spirit of the invention.

What is claimed is:

1. A method for validation of a target environment, comprising:

assembling a validation script from a plurality of script fragments, wherein a script fragment is a component of the validation script that links a data variable of a plurality of data variables with a definition of the data variable and places a result of the linking in a script variable;

inserting the assembled validation script into the target environment;

executing the validation script in the target environment;

gathering results of the executing; and

reporting the results to at least one user;

wherein assembling the validation script comprises:

determining a characteristic of the target environment corresponding to the definition;

determining that a given script fragment corresponds to the characteristic of the target environment;

obtaining parameters for the validation script and writing the plurality of data variables to a database;

querying whether any checklist rules correspond to one or more of the data variables;

querying, when a checklist rule corresponds to one or more of the data variables, whether the checklist rule has been satisfied;

selecting a checklist having the satisfied checklist rule;

querying whether the selected checklist has been completed; and

appending at least one of a functional component and a data component to the validation script upon determining that the selected checklist has been completed; and

wherein the assembling, inserting, executing, gathering and reporting steps are performed by a computer system comprising a memory and at least one processor coupled to the memory.

2. The method according to claim **1**, further comprising:

invoking an external source to supply the characteristic of the target environment.

3. The method according to claim **1**, further comprising:

determining that the script fragments correspond to requirements of a customer.

4. The method according to claim **1**, further comprising:

creating and storing the plurality of script fragments, wherein the script fragments are re-usable.

5. The method according to claim **1**, further comprising:

declaring the plurality of data variables in the script fragments; and

populating the data variables with values obtained from an external source;

wherein the populating comprises dynamically invoking an external agency to supply the values that are locally unavailable.

6. The method according to claim 1, further comprising:
codifying a plurality of customer requirements as a set of questions; and
using one or more of the script fragments to answer the set of the questions.

7. The method according to claim 1, further comprising:
scoping at least a first one of the data variables globally, at least a second one of the data variables to a checklist and at least a third one of the data variables to a request.

8. A system for validation of a target environment, comprising:
a memory and at least one processor operatively coupled to the memory;
a validation module, executed via the at least one processor, and capable of assembling a validation script from a plurality of script fragments, and inserting the assembled validation script into the target environment, wherein a script fragment is a component of the validation script that links a data variable of a plurality of data variables with a definition of the data variable and places a result of the linking in a script variable;
a target module operatively coupled to the validation module and executed via the at least one processor, and capable of executing the validation script in the target environment;
wherein the validation module is further capable of gathering results of the executing; and
a reporting module operatively coupled to the validation module and executed via the at least one processor, and capable of reporting the results to at least one user;
wherein assembling the validation script comprises:
determining a characteristic of the target environment corresponding to the definition;
determining that a given script fragment corresponds to the characteristic of the target environment;
obtaining parameters for the validation script and writing the plurality of data variables to a database;
querying whether any checklist rules correspond to one or more of the data variables;
querying, when a checklist rule corresponds to one or more of the data variables, whether the checklist rule has been satisfied;
selecting a checklist having the satisfied checklist rule;
querying whether the selected checklist has been completed; and
appending at least one of a functional component and a data component to the validation script upon determining that the selected checklist has been completed.

9. The system according to claim 8, wherein the validation module is further capable of invoking an external source to supply the characteristic of the target environment.

10. The system according to claim 8, further comprising a preparatory module capable of creating and storing the plurality of script fragments, wherein the script fragments are re-usable.

11. The system according to claim 8, wherein the validation module is further capable of:
declaring the plurality of data variables in the script fragments; and
populating the data variables with values obtained from an external source;
wherein the populating comprises dynamically invoking an external agency to supply the values that are locally unavailable.

12. The system according to claim 8, wherein the validation module is further capable of:
codifying a plurality of customer requirements as a set of questions; and
using one or more of the script fragments to answer the set of the questions.

13. The system according to claim 8, wherein the validation module is further capable of:
scoping at least a first one of the data variables globally, at least a second one of the data variables to a checklist and at least a third one of the data variables to a request.

14. A computer program product for server validation, the computer program product comprising a computer readable storage medium having program instructions embodied therewith, the program instructions executable by a processor to cause the processor to perform a method comprising:
assembling a validation script from a plurality of script fragments, wherein a script fragment is a component of the validation script that links a data variable of a plurality of data variables with a definition of the data variable and places a result of the linking in a script variable;
inserting the assembled validation script into the target environment;
executing the validation script in the target environment;
gathering results of the executing; and
reporting the results to at least one user;
wherein assembling the validation script comprises:
determining a characteristic of the target environment corresponding to the definition;
determining that a given script fragment corresponds to the characteristic of the target environment;
obtaining parameters for the validation script and writing the plurality of data variables to a database;
querying whether any checklist rules correspond to one or more of the data variables;
querying, when a checklist rule corresponds to one or more of the data variables, whether the checklist rule has been satisfied;
selecting a checklist having the satisfied checklist rule;
querying whether the selected checklist has been completed; and
appending at least one of a functional component and a data component to the validation script upon determining that the selected checklist has been completed.

15. The method according to claim 1, wherein assembling the validation script further comprises:
retrieving the given script fragment; and
incorporating the given script fragment into the validation script using a scripting syntax.

16. The system according to claim 8, wherein assembling the validation script further comprises:
retrieving the given script fragment; and
incorporating the given script fragment into the validation script using a scripting syntax.

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